

CLAIMS:

(amended September 4, 2001)

1. A method for protecting plants shortly before or after the harvest from microbial attack, comprising the distribution or application of an antimicrobial composition to the surface of the plants, said antimicrobial composition containing

(ii) at least one lipophilic GRAS (generally recognized as safe) flavoring agent; and

(ii) at least one hydrophilic GRAS flavoring agent.

2. The method according to claim 1, wherein said lipophilic GRAS flavoring agents are selected from (a₁) lipophilic GRAS flavor alcohols or their derivatives, (b) polyphenol compounds, (c₁) lipophilic GRAS flavor acids or their derivatives, (d) phenols or their derivatives, (e₁) lipophilic esters, (f) terpenes, (g) acetals, (h₁) lipophilic aldehydes and (i) essential oils.

3. The method according to claim 1 or 2, wherein said antimicrobial composition contains at least two lipophilic GRAS flavoring agents, preferably two lipophilic GRAS flavor alcohols (a₁).

4. The method according to claim 2 or 3, wherein said lipophilic GRAS flavor alcohols are selected from: aromatic GRAS flavor alcohols, including

benzyl alcohol, 2-phenylethanol, 1-phenylethanol, cinnamyl alcohol, hydrocinnamyl alcohol, 1-phenyl-1-propanol and anisalcohol, and aliphatic GRAS flavor alcohols, including n-butyl alcohol, iso-butyl alcohol, hexyl alcohol, L-menthol, octyl alcohol, heptyl alcohol, n-amyl alcohol, iso-amyl alcohol, anisalcohol, citronellol, n-decyl alcohol, geraniol, β , γ -hexenol, lauryl alcohol, linalool, nerolidol, nonadienol, nonyl alcohol, rhodinol, terpineol, borneol, clineol, anisole, cuminyl alcohol, 10-undecene-1-ol and 1-hexadecanol and their derivatives, said aromatic GRAS flavor alcohols, especially benzyl alcohol, being preferred.

5. The method according to one or more of claims 1 to 4, wherein said hydrophilic GRAS flavoring agent is a hydrophilic alcoholic GRAS flavoring agent (a_h) or a hydrophilic non-alcoholic GRAS flavoring agent, wherein said hydrophilic alcoholic GRAS flavoring agent (a_h) is preferably a monohydric or polyhydric alcohol having from 2 to 10, more preferably from 2 to 7, carbon atoms, especially one selected from acetoin, ethyl alcohol, propyl alcohol, isopropyl alcohol, propylene glycol and glycerol, and said hydrophilic non-alcoholic GRAS flavoring agent is a hydrophilic organic GRAS flavor acid (C_h) having from 1 to 15 carbon atoms or a physiological salt thereof, a hydrophilic acetate (e_h) or a hydrophilic aldehyde (h_h).
6. The method according to claim 5, wherein said hydrophilic organic acid (C_h) has from 2 to 10 carbon atoms, especially being selected from acetic

acid, aconitic acid, formic acid, malic acid, lactic acid, phenylacetic acid, citric acid, mandelic acid, tartaric acid, fumaric acid, tannic acid, hydrocinnamic acid and their physiological salts; said hydrophilic acetate (e_h) is selected from allicin, triacetin, potassium acetate, sodium acetate and calcium acetate; and/or said hydrophilic aldehyde (h_h) is selected from furfural, propionaldehyde and vanillin.

7. The method according to claim 5, wherein said antimicrobial composition contains less than 50% by weight, preferably less than 30% by weight, more preferably less than 20% by weight, of benzyl alcohol or of a mixture of benzyl alcohol with ethanol and/or isopropanol.

8. The method according to claim 5 or 6, wherein said antimicrobial composition contains two lipophilic GRAS flavor alcohols (a_l), but no benzyl alcohol and no polyphenol compounds (b).

9. The method according to claim 5 or 6, wherein said antimicrobial composition contains benzyl alcohol and/or a polyphenol compound (b), but no further GRAS flavor alcohols.

10. The method according to claim 8 or 9, wherein said antimicrobial composition exclusively contains non-alcoholic hydrophilic GRAS flavoring agents, especially exclusively a hydrophilic GRAS flavor acid (C_h).

11. The method according to claim 9 or 10, wherein said antimicrobial composition contains from 0.01 to 99% by weight, preferably from 0.1 to 90% by weight, of benzyl alcohol or polyphenol compounds (b) and from 0.01 to 50% by weight, preferably from 0.1 to 30% by weight, of hydrophilic non-alcoholic GRAS flavoring agents.

12. The method according to claim 1 or 2, wherein said antimicrobial composition contains
(A) one or more GRAS flavor alcohols (a) or their derivatives; and
(B) one or more flavoring agents selected from polyphenol compounds (b) and lipophilic GRAS flavor acids or their derivatives (c).

13. The method according to claim 12, wherein said antimicrobial composition contains

from 0.1 to 99% by weight, preferably from 0.5 to 99% by weight, of component (a),

from 0 to 25% by weight, preferably from 0.01 to 10% by weight, of component (b), and

from 0 to 70% by weight, preferably from 0.01 to 30% by weight, of component (c).

14. The method according to claim 12 or 13, wherein said antimicrobial composition contains further GRAS flavoring agents selected from (d) phenols or their derivatives, (e_i) lipophilic esters, (f) terpenes, (g) acetals, (h_i) lipophilic aldehydes and (i) essential oils.

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15. The method according to one or more of claims 12 to 14, wherein component (A) of said antimicrobial composition contains benzyl alcohol as a necessary component (a₁) and optionally one or more further lipophilic GRAS flavor alcohols or their derivatives (a_i).

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16. The method according to one or more of claims 12 to 15, wherein said polyphenol compound (b) is selected from:

catechol, resorcinol, hydroquinone, phloroglucinol, pyrogallol, cyclohexane, resveratrol, usnic acid, acylpolyphenols, lignins, anthocyanes, flavones, catechols, gallic acid derivatives, caffeic acid, flavonoids, derivatives of the mentioned polyphenols, and extracts from Camellia, Primula; and said lipophilic GRAS acid (c) is selected from:

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adipic acid, capronic acid, pelargonic acid, phenoxyacetic acid, valeric acid, iso-valeric acid, cinnamic acid, mandelic acid and their derivatives.

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17. The method according to claim 15 or 16, wherein said antimicrobial composition contains

from 0.1 to 99% by weight, preferably from 0.1 to 75% by weight, of benzyl alcohol;

from 0 to 99.8% by weight, preferably from 0.01 to 99% by weight, of component (a₁); and

5 from 0 to 25% by weight, preferably from 0.01 to 10% by weight, of component (b);

from 0 to 70% by weight, preferably from 0.01 to 30% by weight, of component (c).

10 18. The method according to claim 17, wherein said antimicrobial composition contains further lipophilic GRAS flavoring agents (d) to (i), preferably from 0.001 to 25% by weight, more preferably from 0.01 to 9% by weight, of said further GRAS flavoring agents (d) to (i).

15 19. The method according to claim 18, wherein said further lipophilic GRAS flavoring agents are phenols (d) and/or essential oils (i).

20 20. The method according to one or more of claims 1 to 19, wherein said antimicrobial composition does not contain any derivatives of the GRAS flavoring agents.

21. The method according to one or more of claims 15 to 20, wherein said antimicrobial composition contains one or two lipophilic GRAS flavor alcohols (a₁) and at least one polyphenol compound (b).

5 22. The method according to claim 21, wherein said polyphenol compound (b) is tannin.

23. The method according to claim 22, wherein said antimicrobial composition contains from 20 to 98% by weight of benzyl alcohol and from 0.01 to 10%
10 by weight of tannin.

24. The method according to one or more of claims 1 to 23, wherein said antimicrobial composition further contains monohydric or polyhydric alcohols having from 2 to 10 carbon atoms, emulsifiers, stabilizers, antioxidants, preservatives, solvents and/or carriers.
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25. The method according to one or more of claims 1 to 23, wherein said antimicrobial composition exclusively consists of GRAS flavoring agents.

20 26. The method according to one or more of claims 1 to 25, wherein said distribution or application comprises application of said antimicrobial composition to the surface of the plants, especially by spraying, immersion or nebulizing.

27. A method for protecting plants from microbial attack shortly before or after the harvest, comprising the distribution of said antimicrobial composition within the plant, which is effected by adding the antimicrobial composition to nutrient media, nutrient liquids and/or water, said antimicrobial composition containing at least two GRAS (generally recognized as safe) flavoring agents.

28. The method according to claim 27, wherein said GRAS flavoring agents are selected from (a) GRAS flavor alcohols or their derivatives, (b) polyphenol compounds, (c) GRAS flavor acids or their derivatives, (d) phenols or their derivatives, (e) esters, (f) terpenes, (g) acetals, (h) aldehydes and (i) essential oils.

29. The method according to claim 27 or 28, wherein said antimicrobial composition contains at least one GRAS flavor alcohol (a), preferably an aromatic GRAS flavor alcohol, especially benzyl alcohol.

30. The method according to claim 29, wherein said antimicrobial composition contains less than 50% by weight, preferably less than 30% by weight, more preferably less than 20% by weight, of ethanol, isopropanol or benzyl alcohol or a mixture of these substances.

31. The method according to claim 27 or 28, wherein said antimicrobial composition contains at least one hydrophilic alcoholic GRAS flavoring agent and/or one hydrophilic non-alcoholic GRAS flavoring agent.

5 32. The method according to claim 31, wherein said antimicrobial composition further contains benzyl alcohol and/or a polyphenol compound (b).

33. The method according to claim 27 or 28, wherein said antimicrobial composition contains

10 (A) one or more GRAS flavor alcohols (a) or their derivatives; and

(B) one or more flavoring agents selected from

(b) polyphenol compounds; and

(c) GRAS flavor acids or their derivatives.

15 34. The method according to claim 33, wherein said antimicrobial composition contains

from 0.1 to 99% by weight, preferably from 0.5 to 99% by weight, of component (a),

20 from 0 to 25% by weight, preferably from 0.01 to 10% by weight, of component (b), and

from 0 to 70% by weight, preferably from 0.01 to 30% by weight, of component (c).

35. The method according to one or more of claims 27 to 34, wherein said antimicrobial composition contains benzyl alcohol and at least one further GRAS flavoring agent.

5 36. The method according to claim 35, wherein said further GRAS flavoring agents are selected from (a) GRAS flavor alcohols or their derivatives, (b) polyphenol compounds, (c) GRAS flavor acids or their derivatives, (d) phenols or their derivatives, (e) esters, (f) terpenes, (g) acetals, (h) aldehydes and (i) essential oils.

10 37. The method according to claim 36, wherein said antimicrobial composition contains less than 50% by weight, preferably less than 30% by weight, more preferably less than 20% by weight, of benzyl alcohol or of a mixture of benzyl alcohol with ethanol and/or isopropanol.

15 38. The method according to one or more of claims 33 to 36, wherein said antimicrobial composition contains

(a1) benzyl alcohol as a necessary component; and optionally

20 (a2) one or more further GRAS flavor alcohols or their derivatives; and

(b) one or more polyphenol compounds; and/or

(c) one or more GRAS acids or their derivatives.

39. The method according to claim 38, wherein said further GRAS flavor alcohol (a2) is selected from:

acetoin, ethyl alcohol, propyl alcohol, isopropyl alcohol, propylene glycol, glycerol, n-butyl alcohol, iso-butyl alcohol, hexyl alcohol, L-menthol, octyl alcohol, cinnamyl alcohol, α -methylbenzyl alcohol, heptyl alcohol, n-amyl alcohol, iso-amyl alcohol, anisalcohol, citronellol, n-decyl alcohol, geraniol, β , γ -hexenol, lauryl alcohol, linalool, nerolidol, nonadienol, nonyl alcohol, rhodinol, terpineol, borneol, clineol, anisole, cuminyl alcohol, 10-undecene-1-ol, 1-hexadecanol or their derivatives;

said polyphenol compound (b) is selected from:

catechol, resorcinol, hydroquinone, phloroglucinol, pyrogallol, cyclohexane, resveratrol, usnic acid, acylpolyphenols, lignins, anthocyanes, flavones, catechols, gallic acid derivatives, caffeic acid, flavonoids, derivatives of the mentioned polyphenols, and extracts from Camellia, Primula; and

said GRAS acid (c) is selected from:

acetic acid, aconitic acid, adipic acid, formic acid, malic acid, capronic acid, hydrocinnamic acid, pelargonic acid, lactic acid, phenoxyacetic acid, phenylacetic acid, valeric acid, iso-valeric acid, cinnamic acid, citric acid, mandelic acid, tartaric acid, fumaric acid, and their derivatives.

40. The method according to claim 38 or 39, wherein said antimicrobial composition contains

from 0.1 to 99% by weight, preferably from 0.1 to 75% by weight, of benzyl alcohol;

from 0 to 99.8% by weight, preferably from 0.01 to 99% by weight, of component (a2); and

from 0 to 25% by weight, preferably from 0.01 to 10% by weight, of component (b);

from 0 to 70% by weight, preferably from 0.01 to 30% by weight, of component (c).

41. The method according to one or more of claims 38 to 40, wherein said antimicrobial composition contains further GRAS flavoring agents selected from (d) phenols, (e) esters, (f) terpenes, (g) acetals, (h) aldehydes and (i) essential oils.

42. The method according to claim 41, wherein said antimicrobial composition contains from 0.001 to 25% by weight, preferably from 0.01 to 9% by weight, of said further GRAS flavoring agents (d) to (i).

43. The method according to claim 41 or 42, wherein said further GRAS flavoring agents are phenols (d) and/or essential oils (i).

44. The method according to one or more of claims 27 to 43, wherein said antimicrobial composition does not contain any derivatives of the GRAS flavoring agents.

5 45. The method according to one or more of claims 38 to 44, wherein said antimicrobial composition contains one or two GRAS flavor alcohols (a2) and at least one polyphenol compound (b).

10 46. The method according to claim 45, wherein said polyphenol compound (b) is tannin.

47. The method according to claim 46, wherein said antimicrobial composition contains from 20 to 98% by weight of benzyl alcohol and from 0.01 to 10% by weight of tannin.

15 48. The method according to claim 27, wherein said antimicrobial composition is defined as in claims 1 to 25, especially as in claims 12 to 25.

20 49. A method for protecting plants shortly before or after the harvest from insects and insect larvae, comprising:

(i) the distribution or application of an insecticidal composition to the surface of the plants and/or

(ii) the distribution of an insecticidal composition within the plant by adding the insecticidal composition to nutrient media, nutrient liquids and/or water; wherein said insecticidal composition is a composition containing GRAS flavoring agents as defined in claims 1 to 25 and 27 to 48.

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50. The method according to claim 49, wherein said distribution or application of the insecticidal composition to the surface of the plant comprises application of said insecticidal composition to the surface of the plants, especially by spraying, immersion or nebulizing.

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51. The method according to one or more of claims 1 to 50, wherein said plants are selected from cotton, cereals, rice, corn, potatoes, tobacco, coffee, cocoa, tea, vegetables, fruits, nuts, spices, herbs, seeds, ornamental plants, cultured flowers and flowers for cutting.

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52. Use of an antimicrobial composition as defined in claims 1 to 25 and 27 to 48 for the treatment of plants shortly before and after the harvest.